Platform Cooperativism Consortium

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BLOCKCHAIN GOVERNANCE FOR DIGITAL COMMONS AND PLATFORM COOPERATIVES

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Abstract

Digital commons and platform cooperatives represent two powerful movements toward more democratic, community-centered models of digital resource management and platform ownership. However, both face persistent governance challenges, such as administrative complexity, participation fatigue, and the risk of power concentration. Meanwhile, blockchain technology, with smart contract-based governance and decentralized autonomous organizations (DAOs), offers novel tools to enhance the transparency and reliability of the decision-making process. Crucially, while blockchain supplies robust infrastructure, its inherent design—often defaulting to capital-based token voting—does not guarantee democratic or cooperative outcomes; intentional governance mechanisms are required to embed these values. This paper explores the potential synergies among these three domains, highlighting how blockchain governance can address the current limitations of digital commons and platform governance, and how the latter two can, in return, enrich the humanity and social values of blockchain governance by fostering more equitable and participatory structures.

1. Introduction

As the digital economy continues to expand, new forms of collective organization have emerged to manage shared resources and services beyond traditional corporate or state control. Digital commons—like the shared knowledge in Wikipedia and open-source projects in GitHub—demonstrate the ability of communities to collaboratively create and maintain vast shared knowledge bases, software repositories, and open datasets without relying on traditional market or state mechanisms. In parallel, the rise of platform cooperatives aims to reimagine platform ownership and governance by centering control and value distribution among workers, users, and other stakeholders, challenging dominant platform capitalism models exemplified by Uber and Airbnb.

Despite their successes, both digital commons and platform cooperatives grapple with persistent governance challenges. As these organizations scale, they often encounter bureaucratic drift, concentration of authority, participation fatigue, and difficulties balancing operational efficiency with democratic ideals. Wikipedia, for instance, has demonstrated a tendency toward bureaucratization and reliance on increasingly rigid policy-driven gatekeeping as it attempts to maintain quality amidst surging participation, which has inadvertently discouraged new contributors. Similarly, platform cooperatives often find that democratic decision-making trades off with operational efficiency, leading to governance complexity and member participation fatigue. These structural limitations necessitate the exploration of novel, robust mechanisms for decentralized coordination.

Meanwhile, blockchain technology has introduced new paradigms of decentralized governance, particularly through the development of smart contracts and decentralized autonomous organizations (DAOs) (Lumineau et al., 2020). The emergence of DAOs translated organizational structure and decision-making into on-chain protocols. These organizations demonstrate the capacity to pool capital, manage treasuries, and vote on significant strategic changes—all within a framework where every transaction and vote is publicly recorded

and auditable. This radical transparency is a critical advantage over traditional digital commons, where the allocation of resources or the selection of leaders often remains obscure, contributing to user alienation. By defining membership (usually through token holding) and procedures (through governance contracts), DAOs provide a precise and technically robust implementation of Ostrom's principles of clearly defined boundaries and monitoring, which are often difficult to maintain in large, amorphous online communities.

This technological evolution is moving the locus of control from developer teams or corporate entities to the participants themselves. The ability for token holders to propose and vote on changes to the underlying protocol parameters—whether adjusting a fee structure or funding a new development initiative—represents a powerful form of on-chain collective choice. This system offers an immediate, verifiable link between a participant's stake and their governance influence, potentially offering a path to greater democratic legitimacy than traditional models, where input often remains consultative rather than mandatory. While the early history of decentralized governance, notably with the failure of The DAO, highlighted the risks of code vulnerabilities, subsequent protocols have refined these mechanisms, proving that decentralized, rules-based coordination can function effectively at significant scale, particularly within the Decentralized Finance (DeFi) ecosystem. The ultimate promise of this infrastructure is to provide a durable, anti-fragile platform for collective action, capable of withstanding the common pressures of scale and administrative complexity that undermine traditional collaborative ventures.

Nonetheless, blockchain governance itself is not without its own challenges. Tracking the evolution of the renowned MakerDAO, we observe its ongoing efforts to improve and restructure its governance model through initiatives like the "Endgame Plan". Nevertheless, issues of token centralization, technical complexity, and the risk of technocratic elitism—where governance power concentrates among wealthy token holders or technical experts—still exist, presenting a paradoxical drift toward oligarchy. This convergence of challenges across all three domains underscores a central research question: how can decentralized systems be designed to be both efficient and genuinely democratic?

This paper explores how blockchain governance can synergize with digital commons and platform cooperatives to overcome each other's governance challenges to create more robust, transparent, and democratic governance models. Through case studies of Wikipedia, GitHub, Up & Go, Stocksy United, and MakerDAO, we examine the opportunities and challenges facing each domain individually and then discuss an integrated vision where the strengths of each can mutually reinforce the others. Drawing on Elinor Ostrom's principles for commons governance, we argue that a hybrid approach combining blockchain infrastructure with community governance traditions offers a promising path toward equitable, sustainable digital ecosystems.

The remaining content is organized as follows. In Section 2, we introduce the concept of digital commons and their governance challenges, followed by a discussion of platform cooperatives in Section 3. Section 4 delves into blockchain governance, using MakerDAO as a case study to illustrate its evolution and challenges. Finally, Section 5 synthesizes insights from the previous sections to propose a synergistic model for integrating blockchain governance with digital commons and platform cooperatives.

2. Digital Commons

Digital commons are part of the broader commons that exist in cyberspace. They encompass shared digital resources such as a shared knowledge base, open-source software, open data, and collaborative platforms. Similar to the traditional commons, which are characterized by the work of Ostrom (1990) and Bollier (2002), digital commons represent non-excludable resources that a community collectively owns and manages, rather than individuals or corporations. A crucial distinction, noted by Hess and Ostrom (2005), is that digital commons are non-rivalrous. In contrast to physical commons, where one person's consumption depletes the resource for others, the digital nature allows anyone to create a copy of the resource without diminishing the original. This property makes the challenge of managing digital commons one of ensuring sustained contribution and preventing misuse, rather than managing scarcity.

In parallel with the development of the internet and information technology, digital commons have proliferated in the past decades. Wikipedia, the largest online encyclopedia, exemplifies this growth, having expanded from 19 thousand articles in 2001 to 63 million in 2024, with the number of newly registered users reaching 49 million by April 2025. GitHub, the most widely used platform for open-source code, launched in 2008, showcases another dimension of growth; as of April 2025, it hosts over 420 million projects contributed by more than 150 million developers. This vast and rapid expansion highlights the immense capacity for decentralized, voluntary collective action on a global scale. Figure 1 illustrates the growth speed of the volume of digital commons, using Wikipedia as an example.

The governance features of digital commons can vary widely, reflecting the nature of the resource, its specific boundaries, and the composition and cultural norms of the community involved. Key governance dimensions that define these ecosystems include ownership structure, leadership hierarchy, decision-making processes, and quality control mechanisms. Examining diverse examples reveals a spectrum ranging from highly decentralized, community-owned models to centralized, corporate-managed platforms (El Faqir et al., 2020). This diversity highlights that effective commons governance is not a single prescriptive model, but rather a set of adaptable institutional arrangements designed to address unique resource and community challenges.

In the realm of ownership structure, a critical distinction exists between resources collectively owned and governed by their users and those hosted on platforms with proprietary control. In fully community-owned models, the participants directly hold the rights to the platform's intellectual property and data, ensuring that decisions prioritize collective benefit and resource sustainability over external profit maximization (Mannan and Schneider, 2021). This direct ownership aligns strongly with the non-excludable and non-rivalrous nature of the digital commons, guaranteeing that the rules of access and contribution are created by the community itself. Conversely, when digital commons are hosted on commercial or state-controlled infrastructure,

a fundamental misalignment of incentives often emerges. While the resource content may be open and shared, the infrastructure itself—the technological layer that facilitates contribution and access—is subject to external corporate or governmental policy shifts, raising concerns about censorship, monetization, and long-term autonomy.

The dimension of leadership hierarchy further differentiates governance models. Highly decentralized structures often operate with diffused, merit-based leadership where authority is earned through consistent contribution and demonstrated expertise, rather than formal title or capital investment. Decisions in these models rely on rough consensus or sophisticated forms of liquid democracy (Li et al., 2023). However, as the community grows and the technical or administrative complexity of the resource increases, many systems gravitate toward more formalized, often de facto hierarchical control. A small cadre of core administrators or trusted developers may emerge, gaining the necessary authority to enforce policy, manage high-volume technical tasks, and mediate conflicts. While this professionalization of governance can enhance operational efficiency and technical quality control, it simultaneously introduces the risk of oligarchy, concentrating decision-making power and potentially discouraging the participation of newcomers who find the formal structure impenetrable.

Decision-making processes range from anarchist consensus-seeking to structured token-based voting. Fully peer-production models rely heavily on social norms and long, informal deliberation to achieve a broad consensus before implementing significant changes. While this maximizes stakeholder buy-in, it can lead to decision inertia and administrative fatigue. More structured models, including those utilizing technological solutions like smart contracts, formalize these processes, embedding rules for quorum, voting thresholds, and automated rule execution directly into the platform's protocol (Sherman, 2017). The choice of process reflects a trade-off between the desire for inclusive deliberation and the necessity for agile, efficient administration, especially when resources face persistent threats from bad-faith actors or rapid technological evolution. Effective governance must therefore develop mechanisms that

are transparently auditable and fair, regardless of where the system falls on the decentralized-to-centralized spectrum, ensuring the resource remains a collective asset managed for the collective good.

Wikipedia, for instance, is fundamentally a community-driven project and stands as a paradigmatic example of a knowledge commons. It is governed by a non-profit entity, the Wikimedia Foundation, which acts primarily as a supportive organizational and financial backbone rather than a direct content administrator. The actual content governance is executed through a consensus-based method, relying on a complex tapestry of self-governance, elaborate policies, and community-created norms enforced by volunteer administrators and editors. The ownership is collective, the leadership is diffuse, and decisions regarding content inclusion, policy changes, and conflict resolution are processed through formal, multi-tiered systems, evolving from talk pages to complex arbitration committees. This structure attempts to maintain the non-excludable and community-managed nature of the resource, aligning firmly with the ideals of digital commons theory, though facing consistent challenges related to bureaucratization and gatekeeping at scale.

In sharp contrast, GitHub presents a more complex, hybrid model. Despite hosting the world's largest repository of open-source software—a massive, collectively created commons resource—it operates as a commercial platform owned by the corporate entity Microsoft. This ownership structure creates a dual governance layer. At the infrastructural level, ultimate control rests with Microsoft's corporate governance, generating persistent tensions between open-source ideals and centralized platform oversight. This corporate ownership structure means strategic decisions, platform policies, and potential monetization models are dictated by shareholder interests, not community consensus. However, at the decentralized resource level, individual repositories maintain a high degree of autonomy, being owned and governed by project maintainers who dictate contribution processes, accept or reject pull requests, and manage local community standards. This tension highlights the fragility of a commons resource when its infrastructure is privately owned, making the governance of individual codebases susceptible to the strategic shifts of the platform owner.

A third model is represented by Poly Haven, which utilizes a more straightforward, centralized, curatorial structure. Here, a small core team maintains ownership, defines all content policies, and audits the submitted 3D assets. While the resource itself (open-access 3D models and textures) functions as a commons by being available under a permissive license, the governance mechanism is decidedly top-down. Decisions are centrally defined, and quality control relies on expert pre-publication curation by the core team. This model prioritizes consistent quality and streamlined decision-making, trading off the broad democratic participation seen in Wikipedia for efficiency and clear, consistent standards. This case demonstrates that not all successful digital commons adhere to a strictly decentralized governance structure; centralized oversight can sometimes be a pragmatic solution for high-quality, high-specificity resources, though it scores poorly on principles requiring collective-choice arrangements and local control.

These three cases—Wikipedia, GitHub, and Poly Haven—illustrate a critical spectrum of governance configurations in the digital commons landscape: from community-driven consensus with complex administrative overhead (Wikipedia), to corporate-managed infrastructure layered with decentralized project autonomy (GitHub), and finally, to centralized curatorial control prioritizing standards over participation (Poly Haven). The diversity in these models underscores that the effectiveness of governance features is highly contextual. While Wikipedia struggles with balancing openness against the demands of administrative complexity, GitHub struggles with the misalignment between corporate platform ownership and the ethos of its open-source users. This comparative examination provides a foundational understanding of the strengths and inherent vulnerabilities of current digital commons models, setting the stage for the argument that a technological layer must be introduced to fortify the democratic and scalable dimensions of their governance. The key is to borrow the technological robustness of blockchain to resolve the perennial trade-off between democratic participation and operational efficiency, thereby creating a truly resilient, equitable, and globally scalable socio-technical system.

These varied models underscore the complexity of balancing openness, quality, and administrative needs. Table 1 summarizes a comparison of their governance features, while Table 2 compares their alignment with Elinor Ostrom's eight design principles for effective commons governance (Ostrom, 1990). This comparative analysis is crucial for identifying which governance principles are more successfully implemented in various organizational forms and where persistent challenges remain, including ensuring transparent monitoring or developing robust conflict resolution processes.

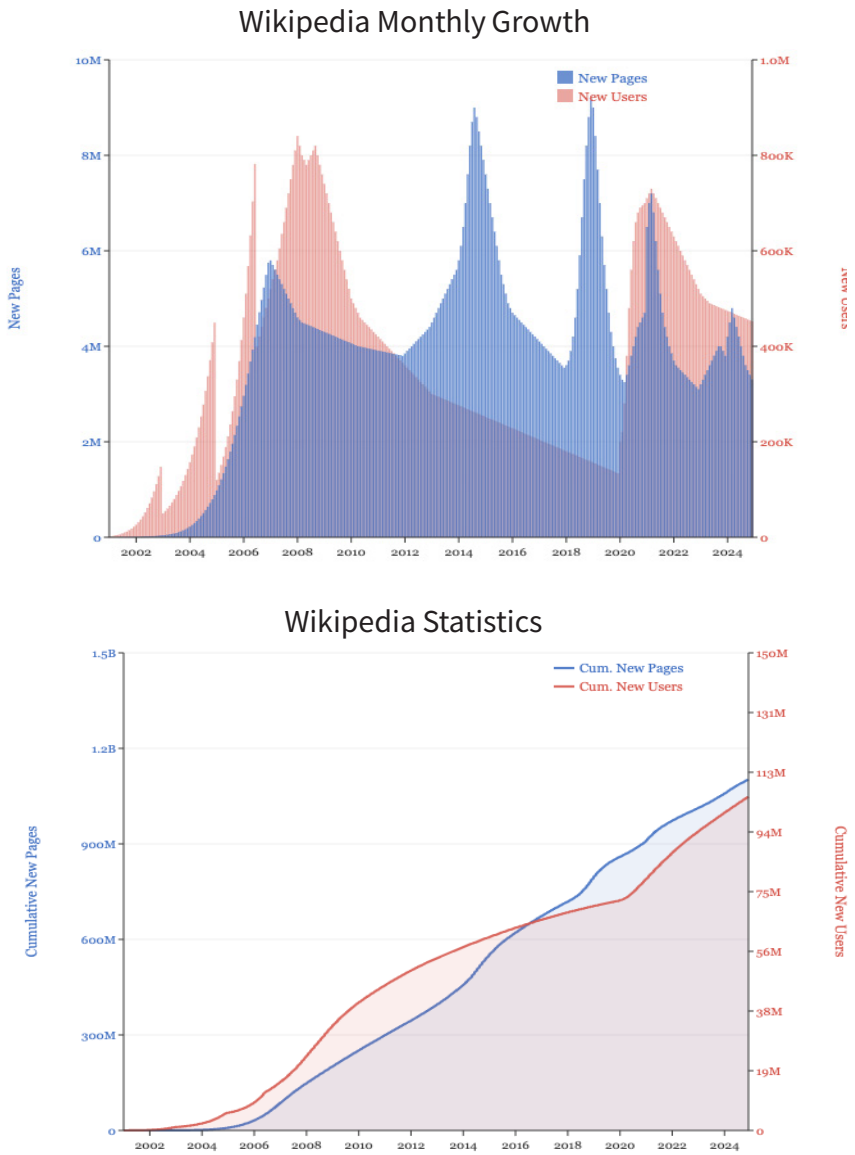

Figure 1: Monthly and cumulative growth of Wikipedia new pages and new registered users from 2001 to 2024. Data source: Wikimedia

Governance Feature	**Wikipedia**	**GitHub**	**Poly Haven**
Leadership	Community-led	Project maintainer	Small core team curation
Decision-Making	Consensus-based with elaborate policies	Maintainer discretion	Centralized curatorial decisions
Contribution Process	Open editing with community oversight	Fork and pull request model	Submission review by core team
Quality Control	Post-publication community review	Pre-merge code review	Pre-publication expert curation
Conflict Resolution	Formal multi-tiered processes	Maintainer judgment with limited appeals	Core team authority
Resource Allocation	Foundation funding with community input	Project maintainer decisions	Patron-influenced priorities
Rules Development	Community- created policies through consensus	Project-specific guidelines by maintainers	Centrally defined standards
Strength	Broad participation and self-governance	Technical innovation through permissionless forking	Consistent standards

Table 1: Comparison of Governance Features among Wikipedia, GitHub, and Poly Haven

Ostrom's Principle	**Wikipedia**	**GitHub**	**Poly Haven**
1. Clearly Defined Bound- aries	Strong - User roles and content poli- cies define who can par- ticipate and what belongs	Strong - Reposito- ry ownership and access controls clearly defined	Strong - Clear quality standards and asset inclu- sion criteria
2. Congruence with Local Conditions	Strong - Language editions and WikiProjects adopt rules to specific contexts	Strong - Each repository can establish custom- ized contribution guidelines	Moderate - Lim- ited adaptation to specific asset categories
3. Collective-Choice Ar- rangements	Strong - Policies developed through consensus with broad participation	Moderate - Project- level participation but platform deci- sions are corporate	Weak - Limited community input on governance decisions
4. Monitoring	Strong - Commu- nity watchlists, Recent Changes patrol, and auto- mated tools	Strong - Code re- view processes and automated testing	Strong - Expert re- view of all submis- sions
5. Graduated Sanc- tions	Strong - System progresses from warnings to blocks to bans	Moderate - Primar- ily accept/reject with feedback	Weak - Binary ac- ceptance model
6. Conflict Resolu- tion	Strong - Formal processes from talk pages to arbitra- tion	Moderate - Project maintainer deci- sions with limited appeals	Weak - Core team authority with minimal formal process

Ostrom's Principle	Wikipedia	GitHub	Poly Haven
7. Rights to Organize	Strong - Community self-governance with minimal foundation interference	Moderate - Project autonomy within platform constraints	Weak - Centralized decision-making
8. Nested Enterprises	Strong - Hierarchical from articles to projects to language editions	Strong - Nested repositories, organizations and foundations	Weak - Simple two- tier structure
Principle Alignment	High	Medium	Low

Table 2: Comparison of Ostrom's Principles Alignment among Wikipedia, GitHub, and Poly Haven

Regardless of the different governance features and alignment with Ostrom's design principles, limitations exist in each of the three digital commons. For example, despite its founding ideals of openness and democracy, Wikipedia has shown an unintended drift toward bureaucratization as the community expanded and governance demands grew. As participation scaled up and the complexity of maintaining the platform increased, more formal structures and administrative roles became necessary. Part of this concentration of authority is a pragmatic response: defending against persistent vandalism, misinformation, and other bad-faith activities has required the delegation of special powers to a smaller group of trusted users.

Notably, this shift has come at a profound cost to the platform's foundational commitment to openness. The imperative to maintain high quality against a surging tide of vandalism and low-quality edits necessitated a defensive turn, manifesting in the simultaneous rise of sophisticated automated tools and increasingly intricate, formal policies. This duality—algorithmic and policy-driven

gatekeeping—disproportionately affected good-faith newcomers who lacked the specialized knowledge needed to navigate the system's growing complexity. The deployment of automated tools, such as edit-reverting bots and predictive filters, prioritized the preservation of the existing content stability over the friction-free onboarding of new contributors. The human complement to this was the rise of powerful editor cliques, often called "deletionists," who amassed specialized knowledge of intricate policy documents, effectively giving them veto power over contributions that did not strictly conform to established style and notability guides. The empirical study demonstrated the dramatic consequence: Wikipedia's attempts to maintain quality amid surging participation led to a rise in these filtering mechanisms, which disproportionately discouraged good-faith newcomers. The result was a sharply declining newcomer retention—from 25.6% in early 2006 to just 11.7% a year later—even though the quality of new contributors remained stable.

These changes fundamentally shifted Wikipedia from a fluid, participatory project, where all edits were equally welcome, to a heavily filtered system where desirable contributors are often deterred before becoming long-term editors. The governance structure became distinctly stratified, moving away from a flat, anarchist ideal to a functional oligarchy. At the apex sit the administrators and bureaucrats who gain their power not through traditional democratic elections, but through the cumulative trust and approval of the existing elite, based on their expertise in complex policy application. These privileged positions grant rights to enforce rules, such as blocking users and deleting pages, effectively creating a technocratic class defined by policy mastery rather than pure technical skill. Below them operate thousands of established core editors, and finally, the vast base of new and occasional users whose contributions are perpetually subject to immediate scrutiny and technological filtering.

As an ongoing challenge, Wikipedia's governance gradually transforms from a truly participatory model into this stratified system, where procedural rigidity and technological enforcement now act as powerful barriers to the very openness the platform was built to champion. The increasing complexity of the policies

themselves has become a form of exclusion; navigating the labyrinthine rules of sourcing, neutrality, and notability requires a dedication of time and effort that only long-term, specialized users can afford, thereby inadvertently reinforcing the power of the established elite. This scenario powerfully illustrates the "iron law of oligarchy" in a digital context, where the operational necessity of quality control leads inexorably to a concentration of power, profoundly compromising the founding democratic ideals of the digital commons. The long-term systemic risk is a potential stagnation of perspective, where the platform fails to attract the diverse global editors necessary to fulfill its goal of providing the sum of all human knowledge.

GitHub, a commercial coding platform owned by Microsoft, presents a revealing case of governance challenges inherent in digital commons, particularly those hosted on centralized infrastructure. While the platform excels at facilitating decentralized open-source collaboration through technical mechanisms like pull requests and forks, ultimate control rests with Microsoft's corporate governance. This fundamental tension between the open-source ideals of autonomy and the reality of centralized platform oversight generates persistent conflicts regarding data control, policy changes, and the platform's overall strategic direction. The acquisition of GitHub by a major corporation amplified these concerns, raising questions about the long-term neutrality and resilience of the ecosystem against corporate commercial interests.

At the project level, governance within individual repositories often struggles acutely with the challenges of scale (Bonnet and Teuteberg, 2024). As code complexity increases and the number of contributors grows, the initial informal peer production model inevitably gives way to a more hierarchical structure controlled by a small group of core maintainers. This consolidation of authority, while pragmatic and intended to preserve code quality and streamline complex technical decision-making, inadvertently risks suppressing broader community participation, discouraging new contributors, and reducing transparency in governance processes. This shift can be seen as a digital manifestation of organizational centralization driven by the necessity of coordination efficiency.

Empirical studies strongly support the concern that these governance practices lead to contributor attrition. Research by Legay et al. (2018) demonstrates that rejected or ignored pull requests significantly reduce the likelihood of continued contributions from affected developers, indicating that the governance interaction itself can become a barrier to future engagement. Furthermore, Khatoonabadi et al. (2023) highlight that complex and opaque review processes, coupled with a lack of clear guidance, often lead to pull request abandonment, particularly among novice contributors. These dynamics illustrate how well-intentioned governance practices, designed for quality assurance, can inadvertently create procedural bottlenecks and lead to a systematic siphoning of valuable community input and labor.

The effect is a gradual but profound erosion of the participatory ethos central to digital commons. By limiting democratic engagement and favoring the established technical elite, GitHub's governance model risks undermining the long-term resilience and innovative capacity of the open-source ecosystems it hosts. The concentration of maintenance responsibilities onto a few burnout-prone core members also poses a single point of failure for critical public infrastructure. The case of GitHub powerfully highlights a systemic challenge: how to design governance mechanisms that can efficiently scale the technical management of complex codebases while simultaneously sustaining broad, democratic participation and preventing the capture of the commons by commercial or elite interests. This tension is precisely where the programmable, transparent nature of blockchain-based governance offers a necessary structural alternative, promising to decouple platform infrastructure ownership from the resource governance process.

3. Platform Cooperatives

Platform cooperatives are digital platforms that share ownership and governance of the platforms among participants, including workers, users, and other stakeholders. They offer goods or services mainly through websites, mobile apps, or protocols. The concept of platform cooperatives was initially proposed

by Scholz (2016) to challenge the dominant paradigm of platform corporations that emerged in sharing economies, exemplified by companies such as Uber and Airbnb.

In direct contrast to platform corporations, which are typically controlled by a centralized, hierarchical entity focused on maximizing profit for investors, platform cooperatives aim to democratize decision-making and ensure a more equitable distribution of benefits. These organizations are structurally designed to prioritize the needs and interests of all stakeholders—including workers and users—rather than solely serving shareholders. This fundamental difference in purpose leads to divergent outcomes in areas such as labor model, accountability, and profit distribution (Bottoni et al., 2020). Platform cooperatives strive for fair wages, robust protections, and participatory workplace practices, making them accountable to their members and local communities. In contrast, platform corporates typically rely on gig work, precarity, and basic protections while being accountable primarily to shareholders and boards. Table 3 systematically outlines these key differences between the two types of platforms. A recent review by Ghirlanda and Kirov (2024) further substantiates this approach by examining platform cooperativism through the lens of stakeholder theory.

Despite the surge in interest and the broad potential of platform cooperatives as a counter-model to platform capitalism, they face several critical challenges in implementation, including issues related to funding, technology, scalability, sustainability, and governance. The commitment to democratic decision-making often necessitates a trade-off with operational efficiency, potentially leading to a more complex governance process (Sharm et al., 2024). Furthermore, the open nature of these cooperatives does not automatically translate into active governance participation from members, suggesting a persistent problem with engagement and “participation fatigue”. Balancing social objectives with commercial viability without compromising core cooperative values presents another significant challenge to long-term sustainability.

Platform cooperatives, though relatively smaller in scale compared to their corporate counterparts, span various sectors to offer alternative goods and services for both workers and users. Examples include Up & Go in-home cleaning, which challenges TaskRabbit; Fairbnb in short-term rentals, which provides an alternative to Airbnb; and Stocksy United in stock photography, which competes with Shutterstock. The global distribution of these projects, as illustrated in Figure 2, demonstrates the movement's broad appeal and potential to establish a more ethically and democratically managed digital economy. The successful expansion of these models requires overcoming the inherent difficulties in maintaining democratic processes while achieving the scale and efficiency necessary for market competition.

	Platform Cooperatives	**Platform Corporates**
Ownership	Owned by workers, users, or communities	Owned by venture capitalists, founders, and shareholders
Governance Purpose	Democratic decision-making	Hierarchical decision-making
Purpose	Serve needs of members and communities	Maximize profit and growth for investors
Profit Distribution	Shared among members or reinvested locally	Concentrated among owners, executives, and investors
Accountability	Accountable to members and local communities	Accountable to shareholders and boards
Labor Model	Aimat fair wages, protections, and participatory workplace practices	Gig work, precarity, basic protections

Table 3: Comparison between Platform Cooperatives and Platform Corporates

Platform cooperatives, though relatively small scale compared to their counterparts of platform corporates, span across various sectors to alternatively provide goods and services for both workers and users. Examples include Up & Go vs. TaskRabbit in Home cleaning, Fairbnb vs. Airbnb in short-term rental, Stocksy United vs. Shutterstock in stock photography, CoopCycle vs. Uber Eats in food delivery, and Resonate vs. Spotify in music streaming. Figure 2 illustrates the emergence of platform cooperatives in different sectors.

Despite the surge in interest in and the broad potential of platform cooperatives, they are facing challenges in multiple aspects, such as funding, technology, scalability, sustainability, and governance. The imperative for democratic decision-making often trades off with operational efficiency, thereby leading to complexity in the governance process. Furthermore, the open nature of platform cooperatives might not inherently facilitate more active governance participation from their members. Balancing social and commercial objectives without compromising the core values of the cooperative remains a persistent difficulty.

Figure 2: Global distribution of platform cooperative 638 projects. Figure source: Platform Cooperativism Consortium.

Up & Go serves as a case illustrating the difficulties of maintaining democratic processes in a growing cooperative. Formed in New York City in 2017, it is a platform cooperative created by a network of worker-owned cooperatives to deliver cleaning services. The platform effectively utilizes a website to manage customer and cleaner matching, service scheduling, and payment processing. Key to its cooperative model, members collectively establish pricing, own the platform's intellectual property, retain 95% of service revenue, and invest the remaining 5% into the platform technology. This structure has resulted in wages that significantly surpass the average sectoral wage. Up & Go convenes monthly meetings for its approximately fifty worker-owners to discuss issues and vote on major decisions. Despite the cooperative's relatively small size, it has already encountered challenges related to conflict resolution and decision-making, such as determining a vaccine mandate policy during the COVID-19 pandemic. This example highlights that even at a modest scale, the commitment to consensus and participatory governance can lead to operational friction and prolonged internal conflict over critical issues.

Stocksy United, a platform cooperative established in 2013, presents a challenge related to scaling a quality-focused, globally distributed membership. Owned by its contributing artists, Stocksy sells curated stock photography and video licenses. The cooperative distributes 50% to 75% of license revenue directly to the contributors. Surplus revenue is distributed with 90% allocated to contributors proportional to their input, 5% to founders and advisors, and 5% to full-time staff.

Stocksy maintains stringent quality control through a selective process for both membership and stock; only a small percentage of applicants are accepted by the selection committee, and a curatorial team reviews all submitted content. Selected artists gain the right to vote, run for the board, and receive dividends. However, the cooperative has faced fundamental governance challenges in balancing democratic decision-making with the demands of strategic growth. This dilemma has raised concerns among members regarding earnings dilution and the preservation of the cooperative identity. Furthermore, the cooperative's

globally distributed membership creates communication barriers stemming from diverse languages and time zone differences, necessitating continuous efforts to ensure inclusivity and transparency across its worldwide base. These cases demonstrate that while platform cooperatives offer compelling ethical and economic models, their commitment to democratic ideals creates inherent administrative and operational hurdles that limit scalability and efficiency.

4. Blockchain for Governance

Blockchain, introduced by Nakamoto (2008), is a decentralized system that uses cryptographic techniques and distributed consensus to securely record transactions in an immutable ledger. Each block of data is linked to the previous one through cryptographic hashes, making tampering virtually impossible and enabling trustless coordination across a peer-to-peer network (de Filippi et al., 2025). This breakthrough in secure data management laid the groundwork for a new kind of digital infrastructure. In its early form, however, governance remained off-chain and informal, relying on developer consensus, community norms, and open-source collaboration rather than explicit voting or institutional structures. Decisions about protocol upgrades or rule changes were made through rough consensus, without built-in mechanisms for stakeholder representation or formalized input.

The launch of Ethereum in 2015 marked a turning point by introducing smart contracts—self-executing programs that reside on the blockchain and automate decision-making when preset conditions are met (Faqir-Rhazoui et al., 2021). This innovation enabled the emergence of on-chain governance, where rules and processes could be encoded directly into the protocol and executed transparently without intermediaries. The first major experiment in decentralized, token-based governance came with The DAO in 2016, a community-directed investment fund governed by token holders through smart contract-based voting. Although The DAO failed due to a vulnerability in its code, it unequivocally demonstrated both the potential and the inherent risks of on-chain collective decision-making.

In the years that followed, protocols like MakerDAO (now rebranded as the Sky project) refined these governance models, especially during the Decentralized Finance (DeFi) boom of 2020. Token holders in these systems gained the ability to propose and vote on changes to protocol parameters, allocate treasury funds, and guide future development. Through these evolving mechanisms, blockchain systems began to transform from purely technical infrastructures into experimental platforms for decentralized, rules-based governance. These platforms offered a potent alternative to traditional corporate and institutional hierarchies by embedding transparent, auditable coordination mechanisms directly into the system's operational code. The shift formalized decision-making processes, moving them from opaque, informal developer groups into programmable systems accessible to token holders.

Table 4 summarizes the alignment of blockchain governance with Elinor Ostrom's eight design principles for effective commons governance. The technology's transparency and programmability ensure a strong fit with principles like Clearly Defined Boundaries, Collective-Choice Arrangements, and Monitoring. However, challenges remain in fully satisfying all principles in the current implementation status. Specifically, the Graduated Sanctions principle is only partially applicable, as binary sanctions are common and fine-grained punishment often still requires human input. The Conflict Resolution principle is still maturing, often necessitating off-chain resolution. Finally, the Rights to Organize principle, while technically feasible on-chain, remains subject to recognition from external legal systems. Nevertheless, the alignment of the other five principles demonstrates blockchain's profound potential as a foundational infrastructure for robust digital commons governance.

Ostrom's Principle	**Blockchain/DAO**
1. Clearly Defined Boundaries	Token issuance and smart contracts define who can participate, vote, and benefit.

Ostrom's Principle	**Blockchain/DAO**
2. Congruence with Local Conditions	Smart contracts can encode custom rules; adaptability to off-chain context often requires oracles or member votes.
3. Collective-Choice Ar- rangements	DAOs allow members to propose and vote on rules and updates via governance protocols.
4. Monitoring	Blockchain's transparency ensures all transactions and votes are publicly recorded and auditable.
5. Graduated Sanctions	Smart contracts can enforce penalties (e.g., slashing, access removal) but proportionate enforcement often needs human input.
6. Conflict Resolution	Some DAOs integrate dispute resolution layers (e.g., Kleros), or community governance handles conflicts via votes.
7. Rights to Organize	Blockchain enables groups to self-govern, and legal wrappers (e.g., DAO LLCs) are emerging for jurisdictional recognition.
8. Nested Enterprises	Modular DAO frameworks support layered governance (e.g., sub- DAOs, working groups, federations).

Table 4: Mapping Ostrom's Principles to Blockchain/DAO Structures

Despite the promise of blockchain governance, it is not without challenges itself. We exemplify the challenges with the case of MakerDAO, one of the earliest and most influential DAOs in the blockchain space. MakerDAO has undergone significant evolution since its inception, transitioning from a simple stablecoin protocol to a complex ecosystem of decentralized governance and financial services. This evolution has been marked by both successes and challenges.

4.1 Case: MakerDAO

MakerDAO, founded in 2015 by Rune Christensen, stands as one of the earliest and most influential decentralized autonomous organizations (DAOs) in the blockchain space. Running on Ethereum, it aims to establish a decentralized, stable financial system. The protocol's product, DAI, is a stablecoin pegged to the U.S. dollar but backed by overcollateralized crypto assets rather than fiat reserves. MakerDAO distinguished itself by operating entirely through smart contracts, eliminating traditional financial intermediaries, and allowing users to lock up cryptocurrency collateral in order to generate Dai. Governance decisions are made by holders of vote equivalents named MKR tokens, who vote on critical issues such as risk parameters, protocol upgrades, and collateral onboarding.

MakerDAO's evolution can be traced through several important phases of increasing complexity and structural adjustment. In 2017, it launched Single Collateral Dai (SCD), initially backed only by Ethereum. Although this model proved the viability of decentralized stablecoins, it was limited in its ability to manage risk and adapt to market fluctuations. In 2019, the transition to Multi-Collateral Dai (MCD) marked a significant expansion, allowing various crypto assets, such as BAT and WBTC, to serve as collateral. This upgrade also introduced new features like the Dai Savings Rate (DSR), enabling users to earn interest on their Dai holdings.

As MakerDAO matured, the demands of operational reality dictated a shift toward specialized administration. It gradually decentralized its internal operations through the establishment of Core Units—autonomous teams tasked with

specific areas like risk management, development, and governance facilitation. While this structure enhanced operational efficiency, it also introduced coordination complexities and governance inefficiencies, characterized by slow decision-making and strategic drift. Recognizing these scaling challenges, Rune Christensen proposed the “Endgame Plan” in 2023. This comprehensive restructuring aimed to modularize governance through the creation of specialized sub-DAOs called MetaDAOs, injecting a controlled hierarchy to improve efficiency. In 2024, MakerDAO officially rebranded as Sky, separating the core Maker Protocol and Dai from its ongoing governance innovations and setting the stage for a more scalable and adaptive DAO ecosystem.

Since its launch in 2017, DAI has experienced significant growth in market capitalization. DAI’s total supply reached $100 million in May 2020 and soon surpassed $5 billion in June 2021. MakerDAO’s exploration of governance structure has shed light on possible forms of financial autonomous governance, and the protocol demonstrated remarkable risk management resilience during the March 2020 market turbulence.

Despite its remarkable uptrend, significant challenges related to governance risks, the efficacy of decision-making, scalability, and regulatory compliance emerged over time. The DAO structure, while preventing arbitrary control from a single entity without voting approval by the majority, is still exposed to security risks, including hacker attacks exploiting malicious code. More fundamentally, the system faces the problem of paradoxical centralization. The analysis of vote participation and the distribution of governance tokens consistently shows an existing concentration of voting power among a relatively small number of large holders. Furthermore, the very solution proposed to enhance efficiency, the Endgame plan, could potentially lead to further centralization due to the introduction of a hierarchy of specific scopes and subDAOs, effectively trading decentralized breadth for administrative depth.

MakerDAO’s evolution illustrates the continuous tension between the ideals and the practicalities of decentralized governance in the blockchain space.

The concentration tendency observed within MakerDAO appears reminiscent of Wikipedia's bureaucratization, raising a broader question: will MakerDAO inevitably reenact the "iron law of oligarchy" described by Michels, or will it successfully transcend the structural limitations traditionally faced by expanding organizations?

Importantly, while the ideal of decentralization serves as a foundational vision for DAOs, it is crucial to recognize that decentralization in its purest form has never been a guaranteed or stable property—and that is an acceptable realization. The true enduring values of MakerDAO and similar blockchain-based organizations lie elsewhere. Their critical advantages persist through the distributed system of immutable and transparent record-keeping, the trackable and reliable execution of smart contracts, and the innovative application of voting mechanisms as governance tools (Batubara et al., 2019). These features, independent of the degree of decentralization at any given moment, offer resilience, audibility, and participatory potential that traditional organizational frameworks struggle to match.

Rather than lamenting the inevitable drift toward certain centralized structures required for operational efficiency, the focus should shift toward reinforcing transparency, ensuring broad participation through mechanisms other than capital ownership, and preserving the accessibility of governance mechanisms. When properly harnessed, these strengths position DAOs to synergize with the governance practices emerging in digital commons and platform cooperatives, offering a promising pathway toward more equitable, transparent, and adaptive forms of collective action.

5. Synergizing Blockchain governance with Digital Commons and Platform Cooperatives

5.1 Potential of synergy

Integrating the analyses presented in previous sections on digital commons, platform cooperatives, and blockchain governance, we observe a compelling potential for synergy among these three domains. Each addresses fundamental challenges of collective ownership, participatory decision-making, and equitable resource management, albeit from different historical and technological contexts. Fundamentally, all share a common goal of fostering collaborative governance structures that empower communities and individuals in the digital sphere.

Digital commons, exemplified by projects like Wikipedia and GitHub, have demonstrated the feasibility of large-scale, voluntary, and collaborative production of common knowledge, productive tools, and materials, with minimal reliance on traditional market or state mechanisms. However, they often struggle with issues such as governance opacity, reliance on informal norms, and vulnerability to power concentration and bureaucratic drift. Platform cooperatives, aiming to reimagine the ownership and governance models of digital platforms, offer a powerful corrective by emphasizing democratic ownership and formalized participatory governance. Nevertheless, they face significant scalability challenges, high administrative overhead, and persistent difficulties ensuring continuous member engagement in decision-making processes.

Blockchain technology, with its core features such as immutable records, automated and transparent rule enforcement via smart contracts, and programmable governance frameworks, provides a powerful infrastructural solution to many of these persistent governance challenges. By embedding

governance rules into code, blockchains can reduce ambiguity, lower administrative costs, and enhance trust among participants with minimal reliance on intermediaries.

The synergy between each pair of the three domains is, in fact, already ignited. For instance, open-source libraries from the digital commons domain offer the backbone technology to develop mobile or web applications that facilitate the business operation of platform cooperatives. Conversely, platform cooperatives can naturally help align incentives with the care, maintenance, and sustainable growth of the digital commons resources. Moreover, participants in blockchain technology mostly host their projects, including codes, website scripts, and documentation, on GitHub, demonstrating a dependency on the existing commons infrastructure. The very development and accumulating records of blockchain itself are recognized as a form of knowledge commons. The integration between platform cooperatives and blockchain has also been an increasing focus of attention, exploring how DAOs can legally or structurally embody cooperative principles (Mannan, 2018).

This confluence suggests that the relationship is not merely one-sided. The synergy among blockchain governance, digital commons, and platform cooperatives operates through three distinct, reciprocal mechanisms: (1) blockchain technology robustly addressing governance challenges in digital commons and platform cooperatives, (2) the established governance practices of commons and cooperatives helping to resolve blockchain's own plutocratic and rigidity limitations, and (3) cross-domain learning that enhances shared ethical and operational standards. This systemic view moves beyond merely applying new technology to old problems and instead frames it as a comprehensive approach to building genuinely democratic, sustainable digital ecosystems. This reciprocal relationship is the foundation for creating hybrid governance systems that are both technologically resilient and socially grounded..

5.2 How Blockchain Governance Enhances Digital Commons

Blockchain technology offers transformative potential in addressing longstanding governance challenges faced by digital commons. By encoding governance processes into transparent, tamper-resistant smart contracts, blockchain reduces reliance on informal norms and administrative bias that have historically left digital commons vulnerable to capture by dominant contributors or elite gatekeepers. This technical robustness directly counteracts the bureaucratic drift and power concentration observed in large-scale commons projects.

The technology's application can combat Quality Control Bottlenecks in digital commons like Wikipedia, where a small group of experienced editors can become gatekeepers, potentially deterring newcomers. A blockchain-enhanced system could implement reputation-weighted review mechanisms where contributors earn transparent, tamper-proof reputation scores based on the quality and acceptance rate of their contributions over time. Smart contracts could automatically route new submissions to reviewers with appropriate expertise levels, distribute review workload more evenly, and provide graduated editing privileges based on demonstrated competence. This process reduces the bottleneck effect of centralized gatekeeping while simultaneously maintaining necessary quality standards.

Furthermore, the technology provides a mechanism for Addressing Bureaucratic Drift in Wikipedia, which can be mitigated through automated governance escalation systems8. Smart contracts could encode Wikipedia's existing multi-tiered conflict resolution procedures, automatically escalating disputes through appropriate channels (e.g., talk pages $\rightarrow$ mediation $\rightarrow$ arbitration) based on predefined criteria and timelines9999. This capability would significantly reduce the administrative burden and subjective bias associated with human moderators while ensuring consistent and impartial

application of community policies, thereby preserving Wikipedia's collaborative spirit and operational efficiency.

For code-based commons, blockchain is critical for Solving Coordination Challenges in GitHub Projects, which often suffer from maintainer burnout and coordination difficulties as they scale. A blockchain governance layer could implement contributor incentive systems where successful code contributions, bug fixes, and community support earn contributors governance tokens representing both voting power and potential economic rewards. Smart contracts could automatically distribute funding from sponsors or users to active contributors based on their token holdings and contribution metrics. This automatic, transparent resource allocation creates sustainable funding models while simultaneously distributing maintenance responsibilities more broadly across the community, ensuring the long-term resilience of the open-source ecosystem. By making contributions and rewards transparently verifiable, blockchain moves resource management out of the hands of centralized platforms and back into the community. This structure provides a durable, auditable framework for rewarding community stewardship, addressing a core weakness of existing digital commons models.

5.3 How Blockchain Governance Enhances Platform Cooperatives

For platform cooperatives, blockchain introduces mechanisms to lower administrative burdens associated with democratic governance while enhancing transparency and member participation (Bunders et al., 2022). The technology enables the automated execution of cooperative principles through programmable governance frameworks, addressing several common scaling issues that plague these models. For instance, in Addressing Participation Fatigue, regular voting on operational matters in platform cooperatives can become time-consuming and lead to declining engagement. Using blockchain-based delegative voting, or liquid democracy, members could delegate their voting power to trusted peers or rotating stewards on specific issues.

These delegates' decisions would be recorded immutably on-chain, ensuring transparency and accountability while significantly reducing the burden on all members to vote on every proposal. Smart contracts can further automate critical governance logistics such as meeting scheduling, quorum checks, and vote tallying, making the governance process seamless and continuous rather than administratively burdensome, thereby increasing the feasibility of large-scale democratic operation.

In Transparent Resource Allocation, platform cooperatives like Stocksy United often struggle with the transparent and fair distribution of profits and decision-making regarding resource allocation, which can lead to internal disputes and uncertainty. Blockchain technology offers a solution by automating transparent profit-sharing algorithms through smart contracts. These contracts can calculate and distribute revenue shares instantly based on predefined and immutable criteria, such as contribution volume, quality ratings, or membership tenure. Members retain democratic control, as they could propose and vote on changes to the allocation formulas through on-chain governance, with all financial flows publicly visible on a ledger. This process eliminates disputes about payment calculations while ensuring alignment with the cooperative principles of fairness and equity.

Finally, in enhancing accountability, worker cooperatives like Up & Go face challenges in ensuring all members fulfill their diverse responsibilities and commitments, which is vital for service quality and internal equity. Blockchain could enable automated accountability tracking where member commitments (e.g., work hours, adherence to quality standards, required training completion) are recorded on-chain through integration with existing work management systems. Smart contracts could then automatically adjust member incentives—such as voting weights, profit shares, or access privileges—based on the verifiable fulfillment of these commitments. This process creates a system of transparent incentive alignment and graduated, automated sanctions, simultaneously reducing administrative oversight costs and reinforcing a culture of mutual responsibility, which is central to the cooperative ethos. By leveraging the

technological advantages of auditable, automated code, platform cooperatives can fortify their democratic foundations against the pressures of scale and complexity.

5.4 How Digital Commons and Platform Cooperatives Enhance Blockchain Governance

Blockchain governance itself faces significant challenges: token governance systems can become plutocratic, dominated by wealthier participants; decision-making processes can become rigid if not carefully designed; and technical complexity can exclude less tech-savvy community members. The fundamental concern is that blockchain's default mechanism of "one-token-one-vote" often reflects capital ownership rather than community stewardship, thereby failing to secure cooperative values. Digital commons and platform cooperatives offer reciprocal solutions to blockchain's governance dilemmas by providing established frameworks for equitable participation and collective deliberation.

To materialize cooperative values within decentralized autonomous organizations (DAOs), the governance design must intentionally embed cooperative principles into the blockchain layer itself. This process requires a shift from simple capital-based voting toward models that reward ongoing commitment, contribution, and broad participation. To address the plutocratic tendencies in token-based DAOs, lessons from cooperative governance can be applied through quadratic voting mechanisms and contribution-weighted participation. Instead of simple token-based voting, smart contracts could implement systems where voting power increases at a diminishing rate relative to token holdings, thereby preventing wealthy participants from dominating decisions. Furthermore, governance power should be tied to diverse contribution metrics (e.g., code commits, community support, content curation) rather than solely financial investment, incorporating the cooperative principle of member participation over capital contribution.

Mechanisms like liquid democracy, where voting power is delegated to trusted, active stewards, can be encoded in smart contracts. This approach acknowledges that not all members can or desire to vote on every issue, while still ensuring accountability through the right to revoke delegation. This process preserves democratic intent while enhancing administrative efficiency, a key lesson from platform cooperatives struggling with participation fatigue. Blockchain infrastructure supplies technical transparency and automated rule enforcement, but cooperative values only materialize when governance design puts people and established community traditions at the center.

The rich history and practices of digital commons offer valuable lessons for fostering norms of cooperation, trust-building, and voluntary contribution that code alone cannot fully capture. Communities like Wikipedia and open-source projects have demonstrated that social norms, informal mediation, and graduated sanctions are essential for maintaining participation and preventing toxic behaviors. Blockchain communities must integrate these practices by establishing mentorship programs, community codes of conduct, and cultural onboarding processes that complement technical governance mechanisms. Platform cooperatives have a tradition of formal deliberation and member education to ensure that decisions are fully understood and supported by the community. DAOs must integrate off-chain deliberation tools—such as structured forums, community calls, and educational resources—to inform on-chain votes. This process ensures that technical decisions reflect genuine consensus and stakeholder needs, thereby mitigating the risk of technocratic elitism often associated with blockchain governance. The synthesis of programmable infrastructure with proven, human-centric governance models creates a framework for truly resilient and equitable digital organizations..

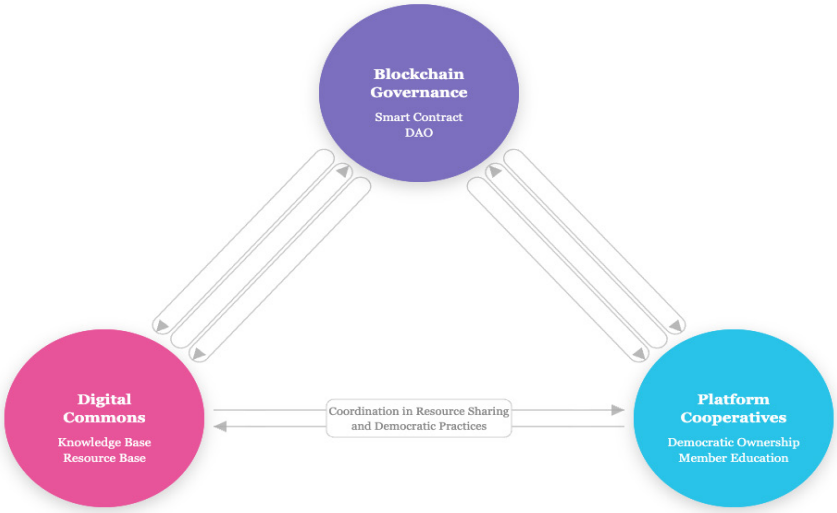

Figure 3: Three-way synergy among blockchain governance, digital commons, and platform cooperatives.

Figure 3 demonstrates the three-way synergy among blockchain governance, digital commons, and platform cooperatives. The combined model resonates strongly with Elinor Ostrom's principles for governing common-pool resources. Blockchain can technologically guarantee clear boundaries, rule enforcement, and monitoring, while digital commons traditions offer experience with organic norm development and graduated sanctions. Platform cooperatives contribute proven models of collective choice and conflict-resolution practices. Together, this hybrid governance system operationalizes Ostrom's design principles not just at local or national scales, but potentially across global, digitally connected communities.

Thus, an organic, reciprocal learning process emerges: blockchain infrastructure can fortify digital commons and platform cooperatives with technical robustness, scalability, and economic incentives, while digital commons and cooperatives can humanize, democratize, and ethically ground blockchain governance. Together, they point toward a future of socio-technical systems that are both decentralized and deeply democratic, capable of sustaining collective action and

equitable resource management on a global scale. This synergy is not merely an amalgamation of tools but a foundational synthesis of technological reliability with established social values.

The foundational contribution of blockchain is its ability to provide an immutable, transparent infrastructure that inherently supports Ostrom's principles of clear boundaries and monitoring. By enabling automated, smart contract-based enforcement of rules, it offers a pathway out of the bureaucratic drift and participation fatigue that challenge established digital commons and platform cooperatives. For the commons, this translates to automated quality control and resource allocation mechanisms that are auditable by the entire community. For cooperatives, it means the ability to implement transparent profit-sharing and sophisticated delegative voting systems, significantly lowering the administrative overhead associated with managing democratic engagement. This technical layer provides the missing element of programmable certainty that traditional, purely social governance structures lack, enabling these organizations to scale without sacrificing their core participatory ideals.

However, the reverse flow of knowledge is equally critical. The experience of digital commons and platform cooperatives acts as the necessary social and ethical corrective for blockchain governance. The history of platform cooperatives provides tested models for embedding democratic principles like contribution-weighted voting and quadratic funding to counter the inherent plutocratic risk of "one-token-one-vote" systems. Furthermore, the long tradition of digital commons has demonstrated that governance requires more than just code; it demands community norms, trust-building, and informal mediation to manage conflict and prevent toxic behaviors. By integrating these social practices—such as community codes of conduct and structured deliberation processes—DAOs can be democratized and humanized, ensuring that technical efficiency serves, rather than subsumes, the goal of equitable and participatory collective action. This hybrid approach operationalizes all of Ostrom's design principles, creating socio-technical systems that are both resilient to technical failure and resistant to social capture.

5.5 Possible Pathway to Synergy

Realizing the synergistic vision outlined above requires concerted efforts across interdisciplinary experimentation, policy innovation, and targeted infrastructure development. The core of this combined model lies in its strong resonance with Elinor Ostrom's principles for governing common-pool resources. Blockchain, at its foundation, serves to technologically guarantee clear boundaries, robust rule enforcement, and transparent monitoring—features often challenging to maintain at scale in purely social systems. Complementing this, digital commons traditions offer invaluable experience with organic norm development and the practical application of graduated sanctions. At the same time, platform cooperatives contribute proven models of collective choice and effective conflict-resolution practices. The deliberate integration of these cooperative and commons principles ensures that the robust infrastructure provided by the blockchain is governed democratically, fundamentally preventing a default to capital-based oligarchy. This hybrid governance system thus operationalizes Ostrom's design principles not just at local or national scales, but across global, digitally connected communities.

A primary focus for the academic community must be empirical pilot studies designed to rigorously test the efficacy and social impact of embedding blockchain-based governance tools within active digital commons and platform cooperatives. These pilots should move beyond theoretical constructs to systematically explore the real-world performance of novel governance mechanisms. For instance, detailed studies are needed to evaluate the practical implementation of mechanisms like liquid democracy, where members delegate their voting power to trusted stewards, and quadratic voting, which is designed to prevent wealthy participants from dominating decisions. Research must also focus on contribution-weighted incentive systems that recognize and reward the labor, time, and intellectual input of participants rather than just their financial stake. Key evaluation metrics must include quantifying changes in member participation rates, assessing the perceived legitimacy of decisions by the community, and measuring administrative efficiency gains compared to traditional governance methods.

Furthermore, comparative governance studies across different cooperative and commons sectors will be essential to identify robust success factors and context-specific design principles. How does a decentralized governance tool perform when managing a labor platform versus a knowledge repository, for example? We need research that identifies which forms of programmable accountability—such as automated adjustments to voting power based on contribution metrics—are most effective in different organizational cultures. This research will help refine the design principles for DAO-cooperative hybrids, ensuring they are adaptable to the varying needs of geographically dispersed and sector-specific communities.

In parallel with academic inquiry, the technical infrastructure must undergo significant development focused on accessibility and ethical design. Developers must prioritize the design of intuitive and accessible governance interfaces that deliberately abstract away the technical complexity of blockchain and smart contracts. These user-friendly interfaces are critical for achieving meaningful participation from non-technical stakeholders, such as workers, content creators, and everyday users. The creation of governance dashboards that display proposals, resource flows, and voting mechanisms in clear, plain language is a non-negotiable step toward bridging the gap between technical protocol and democratic participation. Additionally, infrastructure development should move toward creating modular, plug-and-play DAO frameworks. These standardized, customizable modules would allow existing digital commons and platform cooperatives to easily adopt on-chain governance components without having to build bespoke blockchain solutions, thus reducing financial and technical barriers to entry.

To counteract the risk of technocratic elitism, targeted infrastructure must seamlessly integrate off-chain deliberation and member education tools. These are vital for fostering the social norms that code cannot enforce alone. Tools such as structured forums, decentralized identity systems for reputation building, and platforms for community calls must be organically linked to the on-chain voting process. This structure ensures that technical decisions are always informed by robust community deliberation, upholding the cooperative tradition of member education and consensus-seeking.

Finally, policy frameworks must evolve rapidly to accommodate and support these emerging socio-technical organizational forms, focusing specifically on granting legitimacy while safeguarding democratic principles. A crucial policy step involves exploring and establishing frameworks that grant legal personhood and contractual capacity to blockchain-native entities (e.g., DAO LLCs). This step provides the necessary legal certainty for DAOs to interact with the traditional economy, sign contracts, and own assets, allowing them to function as true economic actors. Concurrently, these legal frameworks must include explicit safeguards to ensure that the DAO structure adheres to fundamental democratic and cooperative values.

Policy must draw a clear distinction between plutocratic token-voting structures and those that genuinely prioritize decentralized, contribution-weighted governance. Regulatory clarity is urgently needed on how cooperative principles like “one-member-one-vote” can be translated into smart contract code using mechanisms like quadratic voting while retaining legal cooperative status. Policymakers should also establish regulatory sandboxes to allow DAO-cooperative hybrids to experiment with novel governance and funding models under limited regulatory oversight. This approach facilitates vital learning and enables legal scholars to develop robust frameworks that support sustainable development and innovation without compromising consumer protection or financial stability. By pursuing these complementary pathways—spanning research, technological design, policy reform, and social integration—researchers and practitioners are able to collectively shape a future of digital governance that is democratic, just, inclusive, and resilient.

5.6 Recommendations for Future Research and Policy

The successful integration of blockchain governance with digital commons and platfely as technical agents but as individuals with defined responsibilities to the collective, similar to union stewards or cooperative directors. Furthermore, regulatory bodies must collaborate to create standardized, international legal

definitions for the various asset classes that underpin these hybrid models—specifically defining governance tokens as distinct from financial securities and legally classifying contribution-weighted incentives as labor compensation rather than mere financial dividends. This clarity is essential for organizations like Up & Go or Stocksy United to operate legally across jurisdictions without undermining worker protections. Without this standardization, the legal complexity inherent in these global digital organizations will continue to suppress their ability to scale.

Future research must undertake a deeper analysis of the systemic risks introduced by the reliance on immutable code. While immutability enhances trust, it simultaneously creates inflexibility, making DAOs brittle and vulnerable to unforeseen market conditions or technical exploits. Researchers should develop failure taxonomies for DAO-cooperative hybrids, classifying risks associated with code rigidity (where a smart contract cannot adapt to a policy change), oracle dependence (reliance on external data feeds that could be compromised), and governance apathy (where delegation chains fracture due to lack of engagement). From a policy perspective, a decentralized insurance and remediation framework should be explored. This framework would necessitate DAOs pooling a portion of their treasury into an emergency fund governed by a dispute resolution layer (similar to Kleros) to offer compensation in the event of smart contract failure or malicious exploits, mitigating risks that currently threaten user confidence and stability.

The synergistic model offers a unique opportunity to redefine data ownership, moving from platform capitalism's extractive model to one of community stewardship. Future research should focus on the ethical architecture of the data commons generated by these hybrids. This process involves designing protocols that enforce data sovereignty, ensuring that the workers and users who generate data (e.g., cleaner performance ratings in Up & Go or photo metadata in Stocksy United) collectively control its access and monetization. This effort requires pioneering the integration of privacy-preserving technologies (like Zero-Knowledge Proofs) directly into smart contracts to enable verifiable accountability without revealing raw personal data. Policy should incentivize

the creation of “data dividends”, where platform cooperative members receive automated, fair compensation for the secondary use of their aggregated data, cementing the principle that data generated within the platform remains a collectively managed asset that benefits all stakeholders, not just external investors. This process reinforces the core social value proposition of the entire movement: placing people at the center of the digital economy.

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Published by the Institute for the Cooperative Digital Economy, March 2026
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